to call "the arbitrary dicta of certain American botanists" animates the utterances of the editor of the *Journal of Botany*. If it does it is at least curious that two scientific men should come to such opposite conclusions upon the same facts as do Mr. James Britten and a strenuous but gentlemanly opponent whose name we withhold but whose voluntary words we are permitted to quote:

"I have greatly regretted the ill-natured statements of J. Britten, especially those in which he implies that there has been any unfair suppression of opinion by the GAZETTE. I am confident that whatever has been rejected by the GAZETTE has been refused for the best reasons and for the sake of harmony and the best good of all concerned."

CURRENT LITERATURE.

The fertilization of Flanders flowers.[1]

In the first part of the introduction the author gives a review of the literature of fertilization and pollination, considering the works of Camerarius, Koelreuter, Sprengel, Darwin, Hildebrand, Delpino, Axell, Müller, Loew, Burck, Weismann, Wallace, and others. In the second part it is insisted that too much importance has been attached to the colors of flowers, and that many characters regarded as adaptations to insects can be otherwise explained. This part also contains a discussion of the Knight-Darwin law, and of the theory of Naegeli, and observations on methods of elucidation of floral mechanisms.

The body of the work, (pp. 130–562), contains descriptions of the indigenous, and some cultivated, species, original and accompanied by many original illustrations, or based on the authority of persons cited. The insects observed on flowers of the entomophilous species are given in each case. The remainder of the work is concerned with general considerations and is followed by a résumé in French.

The region is characterized by being low, having numerous slow streams, frequent rains, fertile soil, mild winters, and summers of moderate heat. There are many anemophilous plants, 215 in a total of 675 species, and few flower-loving insects. In a region which is said to be the most densely populated of the most densely populated country of Europe, the influence of man must be considerable, and this factor is justly estimated by the author.

MacLeod records the results of extensive observations upon the

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[1] McLEOD, DR. JULIUS.—Over de bevruchting der bloemen in het Kempisch gedeelte van Vlaanderen. pp. (1–694). Figs. 125. Ghent. 1894. Reprint from the Botanisch Jaarboek **5**: 156–452. 1893.—**6**: 119–512. 1894.

phenological positions of the anemophilous flowers, as well as the entomophilous flowers and anthophilous insects. It may be worth while to compare these results with those obtained in Illinois, as regards the seasons of some dominant families, giving the number of species in bloom in each month. In the following table, under each family, the first figures are for Flanders, the second for Illinois.

Family.	*No. sp.*	*Mar.*	*Apr.*	*May.*	*June.*	*July.*	*Aug.*	*Sept.*
LILIACEÆ	11	..	2	8	6	2	2	1
	17	1	9	12	6	3	..	..
ORCHIDACEÆ	11	..	..	3	10	7	..	..
	6	..	..	4	2	1	..	1
POLYGONUM	10	..	..	1	4	10	9	6
	11	..	..	.	3	8	11	11
RANUNCULACEÆ	19	..	5	15	17	13	9	5
	19	3	11	14	10	4	2	..
CRUCIFERÆ	31	1	13	25	28	19	14	9
	13	..	9	12	7	5	3	3
ROSACEÆ	24	..	8	15	19	12	9	3
	23	..	8	16	14	8	4	4
LEGUMINOSÆ	31	1	2	14	27	26	23	17
	37	..	2	7	12	20	25	16
UMBELLIFERÆ	26	..	..	7	16	23	23 (1)	13
	19	..	4	12	12	6	4	3
GENTIANACEÆ	6	..	..	1	2	5	5	4
	4	..	..	1	1	1	1	2
BORRAGINACEÆ	11	..	1	10	11	8	5	4
	4	1	3	3	2	1	1	1
LABIATÆ	28	2	5	8	18	24	24	20
	23	..	..	3	8	16	18	18
SCROPHULARIACEÆ	27	2	5	12	22	24	19	13
	20	..	3	8	9	8	11	9
COMPOSITÆ	65	4	5	9	32	63	60	49
	86	..	3	9	17	41	64	75

A comparison of the groups will show that the maxima of the more highly specialized approach more nearly those of the less highly specialized than is the case in Illinois. Several families show June maxima, which is not true of any of them about Carlinville, Ills. The curves given in the *American Naturalist*, Feb. 1895, are based on the actual phenological positions of the plants as indicated in lines representing the blooming periods. This gives quite different results from those obtained by estimating the number of species in bloom during the month. For example, in the table I give nine species of Scrophulariaceæ in bloom in June. There are three species which go out of bloom early in the month and three which come in late, and these are separated by an interval in which only three species are in bloom. My curve for Scrophulariaceæ, therefore, shows a June depression. It will be observed that the maximum number given by MacLeod approaches more nearly the total number of the species in each group. This seems to indicate long blooming seasons, for it is not often that these numbers approximate except when the seasons are long, so as to bring most of the species under the maximum point. Long seasons, on the other hand, may indicate that the natural conditions of competition have been disturbed and that the plants are assuming the habits of introduced plants. As a rule, modification of the flowering season must result inevitably in an alteration in the character of the insect visits.

The seasonal development of the insect groups resembles what I have observed for Illinois. The lower Hymenoptera (allotropic) reach their maximum in June, while my observations indicate a maximum in July, and it may prove to be even later. The *hemitrope* Diptera agree in showing a late maximum, but in Illinois the Syrphidæ preponderate early.

Warming has shown that in Greenland, where flower insects are less abundant, the plants with rich vegetative reproduction are adapted to cross-pollination, while those lacking this power of multiplication are self-pollinating. The former may hold their own, at least for a considerable time, if pollination fails, but in the latter failure to pollinate must soon result in extinction. According to MacLeod certain sacrifices must be made in order to attract insects. The materials which serve for the production of nectar and attractive odors are derived largely from reserves which the plant holds when the flowering season commences. If these reserves are considerable, the plant will attract numerous insects and will become adapted to cross-pollination. If, on the other hand, the reserve materials are slight, the plant can use only a small part of them for the attraction of insects, a greater part being reserved for the nourishment of the fruit and seeds. The expenses in that direction being limited, the flowers are less likely to be visited by insects, and accordingly will self-pollinate more frequently. For this reason, the author divides the plants into two sets, capitalists and proletaires, the former consisting of trees, shrubs, herbaceous perennials, biennials and some annuals, the latter containing most of the annuals. It is admitted that a reduction of capital results from a shortening of life, in which man is an important factor. The proletaires are found almost exclusively upon cultivated lands where as a rule it is impossible for the capitalists to endure. They offset the disadvantages arising from the continual disturbances of the soil by a great fertility. On lands which for some time are not disturbed by cultivation MacLeod observes that the proletaires are rapidly crowded out by the capitalists. The selfpollinated plants thus show an advantage over the cross-pollinated only under the pseudo-ecological conditions induced by the hand of man. This disposes of one of the objections of the apostles of self-pollination who have long been distinguished for a facility in mixing heterogeneous data.

On the relation between the mode of pollen transfer and the structure of fruits, the author calls attention to the fact that in wind-pollinated plants, in a great majority of cases, the fruit is one-seeded or few-seeded, while among entomophilous plants the fruit is commonly many-seeded. This is explained as owing to the fact that in the latter case the pollen is more readily carried in quantity sufficient to fertilize many ovules. Among the indigenous plants *Populus* and *Juncus* are the only anemophilous species which are polyspermous. The case of *Juncus* may be explained by the fact that many of the species can self-pollinate. That of *Populus* may be accounted for on the hypothesis that the plants are descendants of entomophilous forms. I suspect that this hypothesis may be shown to be quite probable. Warming has observed that in the Arctic regions *Salix* shows a disposition to resort to anemophily, and this will support us in the supposition that *Populus* has gone through an entomophilous stage. To the indirect agency of insects, therefore, it seems that we must attribute the development of the great variety of polyspermous dehiscent fruits. The theory suggests that the union of many pollen grains in compact masses, as a favoring condition, may explain the development of a high degree of polyspermy in the orchids.

MacLeod has produced an admirable work which well deserves being cited by Willis[1] as a model of this kind of investigation.—CHARLES ROBERTSON.

Minor Notices.

ANOTHER VOLUME in the botanical series of Ostwald's Classics[2] introduces the reader to Andrew Knight[3] and his writings. Six of Knight's interesting articles from the Transactions of the Royal Society, beginning with that most famous one of all which proved that roots and stems take their position in response to gravity, are given, followed by a brief sketch of his life, notes by the translator, and an enumeration of 93 titles of articles on plants published between 1795 and 1838. Knight wrote in a very attractive way, and for many reasons these essays are rightly considered classical. This neat little volume merits a warm reception from the public.

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[1] The Natural History of the Flower. Natural Science **4:** 351. My 1894.

[2] Earlier numbers are reviewed in this journal, **19:** 207.

[3] KNIGHT, THOMAS ANDREW.—Sechs pflanzenphysiologische Abhandlungen (1803–1812). Uebersetzt und herausgegeben von H. Ambronn. Ostwald's Klassiker der exakten Wissenschaften, Nr. 62. 12mo. pp. 63. Leipzig, Wilhelm Engelmann, 1895. *M*1.